

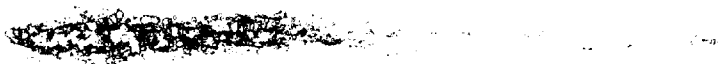
Unusual Features of Noise Barriers

and

Other (Non Barrier) Abatement

Measures

Implemented by December 31, 1988



by

U.S. Department of Transportation
Federal Highway Administration
Office of Environmental Policy
Noise and Air Analysis Division
Washington, D.C.

June 1989

Introduction

The Federal-Aid Highway Program Manual 7-7-3 lists several different types of abatement measures that should be considered when traffic noise impacts are identified (i.e. traffic management, buffer zones, noise barriers, building insulation). The construction of noise barriers is the most commonly used measure, but some States have made limited use of other measures as well as constructing barriers that have unusual features (design or material).

Purpose

The purpose of this paper is to discuss State experience with non-barrier abatement and with unusual barrier features. This paper contains a listing of unusual highway traffic noise barriers and other traffic noise abatement measures implemented in 20 states and the Commonwealth of Puerto Rico.

These measures include items such as sound absorbing barriers and tilted barriers, which are extensions of ordinary barrier construction. Items also included are noise insulation of a historic building, a transparent wall, and a deck over a freeway that is open on one side. These are essentially one-of-a-kind measures that are not simple extensions of ordinary practice.

Summary

Table 1 lists the general categories of measures, as well as the number of States that have implemented the measures and, where applicable, the length of physically constructed barriers.

TABLE 1

Summary of Types of Unusual Noise Barriers and Other
(Non Barrier) Abatement Measures

<u>Type of Measure</u>	<u>No. of States with Experience</u>	<u>Approx Length of Physical Construction</u>
Sound Absorbing Barriers	7	5 miles
Barriers on Structure	6	1 mile
Barrier Outside State Highway Administration		
(SHA) Right of Way (ROW)	2	1 mile
Decks over Freeway*	2	1 mile
Tilted Barriers	3	4 miles
Truck Restrictions*	3	NA
Translucent/Transparent Barriers	2	.3 mile
Noise Insulation	10	NA
Unusual Designs/Materials for barriers	6	1 mile
Private Barrier on SHA ROW	1	.1 mile
School Classroom Construction	1**	NA

* where the measure was implemented in large part to abate traffic noise

** Commonwealth of Puerto Rico

It should be noted for comparison that according to the Federal Highway Administration's (FHWA's) "Summary of Noise Barriers Constructed by December 31, 1986", there were about 467 miles of 'regular' barriers as of that date.

A brief summary of unusual barriers and other traffic noise

abatement measures follows:

Sound Absorbing Barriers

As noted in Table 1, seven states (California, Connecticut, Illinois, Maryland, New Jersey, Pennsylvania, Tennessee) have constructed about 5 miles of sound absorbing barriers as of the end of 1988. In almost all cases, these barriers are in situations in which a barrier has been constructed on both sides of the highway (i.e., parallel barriers).

The aim of such barriers is to prevent reflected noise from degrading barrier performance. This degradation is predicted by some modeling studies. A number of attempts have been made by researchers and engineers to specifically measure an increase in noise caused by reflection between parallel barriers or caused by the simpler single barrier reflection. So far, not one has been able to conclusively measure an increase of greater than 1 dBA (which is generally considered to be an acoustically imperceptible increase).

Materials used have included textured masonry and concrete, mineralized wood, or paper cemented to concrete and rockwool between sheets of another material. In some locations, the additional cost specifically due to the sound absorbing feature has been quite modest (e.g., less than \$1/square foot). In other locations, the total barrier costs have exceeded \$20/square foot (typical installed barrier costs nationally range from \$10 to \$18/square foot). In one location, the surface of metal/rockwool panels was peeling within only 2 years of construction.

Barriers on Structure

As noted in Table 1, six states (Colorado, Minnesota, Oregon, Pennsylvania, Tennessee, Utah) have constructed about 1 mile of barriers on structure as of the end of 1988. In only 1 of 17

installations, the barrier required structural augmentation to withstand the additional loading. Of the 17 barriers, 12 were metal, 3 concrete and 2 wood. Installed costs ranged from \$15 to \$35/square foot.

Barriers Outside the SHA ROW

As noted in Table 1, two states (California, Oregon) have constructed about 1 mile of barriers outside the SHA ROW as of the end of 1988. This includes 7 specific locations. In two of these locations, the barrier provides abatement from both highway and rail traffic noise. In one of these cases, a private easement was required. In three cases, the barrier was constructed, at least partially, on municipally owned property. In the other cases, easements and permits were required for the entire barrier because there was no practical location within the SHA ROW.

Decks over Freeway

As noted in Table 1, two states (New Jersey, Washington) have constructed about 1 mile of decking over freeways as of the end of 1988, where the deck was constructed in large part to abate traffic noise. This includes 3 locations. A total of about 1.2 million square feet (about 29 acres) of decks have been constructed. The cost has averaged about \$250/square foot of deck.

Tilted Barriers

As noted in the Table 1, three states (Nevada, New Jersey, Washington) have designed and constructed about 4 miles of tilted barriers as of the end of 1988. All of these barriers tilt away from the highway (i.e., top of barrier is further from the highway than the bottom of the barrier). Typically, the tilt is about 10 degrees. Tilted barriers are used for the same reason as sound absorbing barriers, that is to prevent reflected noise.

Although not specifically known, the additional cost specifically due to the tilted feature seems modest as unit costs of tilted barriers (\$6 to \$19/square foot) are similar to that of non-tilted barriers.

Truck Restrictions

As noted in Table 1, truck restrictions implemented in large part to abate traffic noise occur in 3 states (Maryland, Minnesota, Oregon) as of the end of 1988. In two cases, noise barriers were constructed in addition to the truck restriction. In one case, the truck restriction was combined with a speed restriction for automobiles, a requirement for a bituminous surface, and a noise barrier (a court suit still resulted on this project).

FHWA does not generally allow restrictions of truck-trailer combinations on those facilities on the National Network for large trucks. Facilities on the National Network were designated by FHWA in response to the 1982 Surface Transportation Assistance Act, as amended and include interstates and some other Federal-aid primaries. An exception to this position is possible only if environmental considerations necessitate truck restrictions as part of a particular Federal-aid highway project or if the State can justify removal of the facility from the National Network based on safety considerations.

Translucent/Transparent Barriers

As noted in Table 1, two states (Maryland, Massachusetts) have constructed about 0.3 mile of translucent/transparent barriers as of the end of 1988. Installed costs have been \$40 to \$50/square foot. In the case of the translucent barrier, the opacity of the barrier has been increasing over time. The transparent barrier has developed cracks in the panel corners within 2 years of construction.

Noise Insulation

Noise insulation of public buildings is routinely evaluated for reasonableness and feasibility to reduce traffic noise impacts. However, noise insulation of private residences is only evaluated when severe traffic noise impacts exist or are expected, and none of the usual abatement measures such as barriers are physically feasible or economically reasonable.

As noted in Table 1, 10 states (Arizona, California, Iowa, Kentucky, Michigan, New Jersey, New York, Oregon, Pennsylvania, Virginia) have experience with this abatement measure as of the end of 1988. About \$25,000,000 has been spent nationally on this measure, of which about 50% has been in the Los Angeles area. Approximately 5 churches, 75 residences (all but 5 on one project in Warren, Michigan) and 100 schools have been treated. Costs range from under \$5,000 for installation of window unit air conditioning and sealing of windows in schools or central air conditioning (where homes already have ducting) and window sealing in residences to \$10,000 to \$400,000 for whole building air conditioning/ventilation in churches and schools to \$1,000,000 or more for air conditioning and window treatment of historic buildings.

Unusual Designs/Material

As noted in Table 1, six states (Arizona, Minnesota, New Jersey, Oregon, Pennsylvania, Washington) have constructed about 1 mile of barriers with unusual designs/materials as of the end of 1988. An example of an unambiguous success has been the case where a college fabricated noise barrier panels from diseased dutch elm wood that would otherwise have been discarded. The panels were installed at minimal cost to the SHA and have lasted 10 years with little maintenance.

An example of a problem has been the case where a SHA specified

(due to neighborhood desires based on information provided by the sole supplier of a particular type of barrier) use of a proprietary barrier made of concrete cribbing within which earth fill and vegetation would be placed. The barrier cost was quoted, prior to the letting, at \$18.75/square foot but escalated in the contractor's bid to about \$50/square foot. Establishment of vegetation on this barrier has been slow.

Private Barrier on SHA ROW

As noted in Table 1, one state (Washington) has permitted a noise barrier to be constructed by a private group on SHA ROW.

School Classroom Construction

As noted in Table 1, Puerto Rico has constructed classrooms on the 'quiet' side of a building as a mitigation for a noise impact on the other side of that building.